

Claims

1. A robotic instrument for microchannel chemical analysis comprising:

a microchip substrate mounted on a first frame, the substrate having a plurality of microchannels therein with inlet ports in fluid communication with the microchannels,

a first track having the first frame movably mounted thereon,

a microtiter plate, having a plurality of spaced apart wells whose positions are known, mounted on a second frame,

a second track having the microtiter plate movably mounted thereon,

a gantry spanning the first and second tracks at an elevation above the tracks, the gantry carrying a multifunctional device being horizontally movable on the gantry and vertically movable from the gantry towards and away from the first track, and

a plurality of motors arranged to provide motive power to the multifunctional device, the first frame, and the second frame.

2. The apparatus of claim 1 further defined by a substrate gripper movable to the first frame from other locations, the gripper having a motor controlling vertical and horizontal motion.

3. The robotic instrument of claim 1 further comprising a plurality of electrode wires mounted on a platform above the first track for insertable into inlet ports of the substrate.

4. The robotic instrument of claim 3 further comprising a circuit board mounted to said platform wherein said electrode wires extend perpendicularly from said circuit board of said platform.

5. The robotic instrument of claim 4 wherein said circuit board has:

a first electrode terminal in electrical communication with a first wire trace and sample terminals of said microchip substrate,

a second electrode terminal in electrical communication with a second wire trace and cathode terminals of said microchip substrate,

a third electrode terminal in electrical communication with a third wire trace and waste terminals of said microchip substrate, and

a fourth electrode terminal in electrical communication with a fourth wire trace and an anode terminal of said microchip substrate.

6. The apparatus of claim 5 further comprising a fifth electrode terminal in electrical communication with a fifth wire trace and a second set of sample terminals of said microchip substrate.

7. The robotic instrument of claim 1 further comprising a detector located on a platform above the first track.

8. The robotic instrument of claim 7 wherein said detector includes a scanning confocal laser microscope.

9. The robotic instrument of claim 1 further comprising a platform above the first track, said platform having a detector and a plurality of wires located on it.

10. The robotic instrument of claim 1 wherein said multifunctional device includes a plurality of pipettors.

11. The robotic instrument of claim 10 wherein said plurality of pipettors have a spacing between each pipettor that matches the spacing between each of the wells of said spaced apart wells.

12. The robotic instrument of claim 10 further comprising a tip guide wherein said plurality of pipettors have tips that are inserted through said tip guide.

13. The robotic instrument of claim 10 further comprising a pipettor assembly actuator.

14. The apparatus of claim 3 further comprising an electrode wire wash station on said first frame.

15. The apparatus of claim 1 further comprising optical and mechanical position sensors located on said first and second frames.

16. A robotic instrument for microchannel chemical analysis comprising, a plurality of microchannels formed in a substrate, the microchannels having a closed cross-section and at a first end, a plurality of ports and at a

second end a common port, a plurality of wells spaced apart from the microchannels containing fluid sample to be inserted into selected ports of the microchannels, an automated multifunctional device movable between the first end ports and the sample wells, adapted to insert fluid sample into selected ports of the microchannels, and an array of electrode wires insertable into selected ports of the microchannels, whereby voltage applied to the array of electrode wires causes molecular migration in the microchannels.

17. The apparatus of claim 16 further defined by a gantry supporting the multifunctional device, the multifunctional device being movable relative to the sample plates and the microchip.

18. The apparatus of claim 16 wherein the number of microchannels is at least eight.

19. The apparatus of claim 16 wherein the plurality of wells are disposed in a microtiter plate which is movably mounted in a second track.

20. The apparatus of claim 19 wherein said substrate is movably disposed in a first track.

21. The apparatus of claim 20 wherein said first and second tracks are spanned by a gantry supporting the multifunctional device.

22. The apparatus of claim 19 wherein a molecular separation optical detector is disposed above or below the first track, the optical detector associated with the scanning beam.

23. The apparatus of claim 22 wherein the microchannels have portions aligned in a closely parallel arrangement whereby the scanning beam scans transverse to the parallel alignment.

24. The apparatus of claim 16 further comprising an electrode wash station movable relative to said array of electrode wires.

25. A robotic instrument for microchannel chemistry comprising:

a first microchip substrate having a plurality of microchannels therein mounted on a first frame, the first frame having microchannel loading apparatus associated therewith,

a second frame having microchannel sample analysis equipment therein,

a robotic arm rotationally movable about a central axis and having an arm capable of carrying a microchip substrate, the arm movable between the first and second frames, and

a plurality of stations disposed in proximity to the rotational movement of the robot arm, at least some stations servicing the microchannel loading apparatus.

26. The apparatus of claim 25 further comprising a second microchip substrate mounted on said second frame wherein said second substrate had sample loaded onto it

while on said first frame with said microchannel loading apparatus and was carried by said robotic arm to said second frame before said first microchip substrate was mounted on said first frame and wherein said first substrate receives sample from said loading apparatus as sample from said second microchip substrate is undergoing electrophoresis and target molecules are simultaneously being detected by said sample analysis equipment.

27. The apparatus of claim 25 wherein said microchannel loading apparatus includes a ganged pipettor.

28. The apparatus of claim 27 wherein one of said plurality of stations is a used pipette tip station.

29. The apparatus of claim 27 wherein one of said plurality of stations is a new pipette tip station.

30. The apparatus of claim 25 wherein one of said plurality of stations is a new sample station.